February, 1958

THE CHEMIST

VOLUME XXXV NUMBER 2

Dr. W. E. Hanford

Receives Honorary AIC Membership

(See Page 45)

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Vol. XXXV February, 1958 Number 2

Deadlines for *The Chemist*

The April issue of The Chemist will contain the Directory of AIC Members. Advertising copy for April should be received not later than March 15th.

IN THIS ISSUE

TO COME IN MARCH

Dr. Glenn E. Ullyot, F.A.I.C., of Smith Kline & French, Inc., will show how firms can increase profits by improving the scientific environment. He recently received the Pennsylvania Chapter Honor Scroll. Dr. Richard T. Arnold, of the Alfred P. Sloan Foundation, contributes some thoughts on scientific creativity. Ernest Hart, president, Food Machinery and Chemical Corporation, tells how management evaluates prospective chemical executives.

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EDITORIAL

The Utilization of Scientific Personnel

Ed. F. Degering, F.A.I.C.

26 Robin Hood Road, Natick, Mass.

THE first and foremost requirement for accelerated scientific progress in the United States is to use efficiently the scientific personnel we actually have. This has been pointed out previously in THE CHEMIST (April 1956).

Our failure to use technical manpower efficiently is not a new thing, particularly in the Department of Defense. We recently came across a copy of a letter, written over thirteen years ago, which called attention to the thoughtless use of our young scientists:

March 23, 1944

Commander in Chief of the U. S. Armed Forces
President Franklin Delano Roosevelt

Dear Commander in Chief:

On the 16th of July, 1943, I received a commission of Temporary Appointment to Captain, Sn-AUS (A 0-528461), which I was not permitted to accept because of the importance of my teaching and research program. It now appears that there is some confusion as to whether we are to continue to use our scientific talent where it can do us the most good, both in the winning of the war and in the maintenance of the peace, or whether we will send the flower of our scientific thought forth to battle, as Italy did with its Mosley in the Last World War.

I am one of a few hundred university professors who is carrying on back of the lines by educating young men to think and work with the tools of science. All of our personnel fall in the 18 to 26 year group. If these men are sent into the armed forces, instead of continuing their training and research, we will not be able to compete satisfactorily in the chemical field after the war. I can assure you that neither England, Russia, nor China, will be found sending the cream of their scientific thought into the front lines of the battle.

I have, as a few hundred other university professors, about a dozen men who are doing graduate work in chemistry. These boys are working a minimum of 30 hours a week in the research laboratory on the production of such things as chemicals for waterproofing fabrics, intermediates from non-strategic materials for synthetic rubber and plastics, medicinals of the quinine and sulfanilamide type, and salt water soaps. In addition, they are doing a minimum of 15 hours of library research a week. During their other hours they are carrying advanced courses in the University. Of their time, consequently, 44 hours per week are devoted to research which is directly connected with the war effort.

Under their present program, these men, of which there are a few thousand at best, are making their contribution by carrying forward research on the production of essential chemicals and processes, and at the same time are preparing for an important place in conceiving, planning, designing, constructing, and operating the chemical industries of tomorrow.

Deprive us of these young boys, and the effect will be felt for a full generation after the war is ended. We cannot let science down! I submit for your consideration the desirability and urgency of keeping these university professors, and their army of young scientists, at their present job of contributing to both the winning of the

war and the maintenance of the peace which is to follow.
—Ed. F. Degering
Professor of Organic Chemistry

It is encouraging to note that serious attention is now being given to the proper utilization of scientific personnel. The President's Committee on Scientists and Engineers, March, 1957, created a Task Force on Technical Manpower Utilization. Dr. Eric Walker is chairman of this group and Dr. Maynard Boring of General Electric is vice chairman. A summary of this group's work on "Utilization Conferences" at colleges and universities is given in the *Newsletter* (No. 110, Dec. 9, 1957) of the Engineering Manpower Commission of EJC and the Scientific Manpower Commission. A copy of this summary may be obtained from Engineers Joint Council, 29 W. 39 St., N.Y. 18, N.Y.

Special AIC Announcements

Gold Medalist for 1958

Lawrence Flett, Hon. AIC, consultant, National Aniline Division, Allied Chemical & Dye Corporation, New York, N. Y., and former president of the AIC, has been unanimously chosen to receive the 1958 Gold Medal, to be presented in Los Angeles, California, during the 35th Annual Meeting, April 10-11, 1958.

Dr. Donald B. Keyes, F.A.I.C., chairman of the Committee on Gold Medal Award, stated that the award was made in recognition of Mr. Flett's research achievements, his devotion to the profession of chemistry, and his long and unselfish promotion of the professional welfare of fellow chemists through the medium of scientific societies.

Dr. Hass' Itinerary

Dr. Henry B. Hass, AIC President, who recently visited the New York, New Jersey, and Pennsylvania Chapters, will present the certificate of Honorary AIC Membership to Harold Levey, F.A.I.C., at a meeting of the Louisiana Chapter, February 6th. From February 19th to March 12th, Dr. Hass will be in Europe visiting members of the Sugar Association. After his return, he will speak before the Washington, Baltimore, New England, Chicago, Niagara, Twin City, Alabama and Ohio Chapters, and attend the 35th Annual AIC Meeting in Los Angeles, April 10-11th.

35th Annual Meeting Program

The timely, general theme of this meeting is "The Chemist and the Public." The program will include three professional sessions: The first will be held Thursday afternoon, April 10, 1958, on the subject of "The Chemist and National Defense." Dr.

Emil Ott, AIC president-elect, will preside.

The second professional session will be held Friday morning, April 11th, on: "The Chemist and Public Education." Dr. Harry L. Fisher, Hon. AIC, will preside. The subject of the third professional session, to be held on Friday afternoon, is "The Chemist and the Community." Dr. Frederick G. Sawyer, F.A.I.C., will preside. Outstanding national speakers have accepted invitations to present their views at these sessions. (A complete program will appear in the March CHEMIST.)

The AIC Gold Medal for 1958 will be presented to Lawrence Flett, Hon. AIC, at a banquet on Thursday evening, April 10th. On Thursday morning, the 35th Annual Business meeting of the AIC will take place, followed by the Keynote Luncheon. Alfred J. Webber, chairman of the Western Chapter, will preside at the luncheon. On Friday, Dr. Henry B. Hass, AIC president, will present the "President's Address," and John Nair, recent AIC president, will preside, at the "Institute Luncheon."

Plan now to come to this meeting at the Ambassador Hotel, Los Angeles, Calif., in April, and make our 35th Anniversary meeting an outstanding success!

Social Hour in San Francisco

In connection with the American Chemical Society's national meeting in San Francisco, California, there will be a "Social Hour" for AIC members and their friends, on either Monday, April 14th or Tuesday, April 15th. Look for the announcement in the ACS program, or in the March 10th edition of C & E N.

New Chairman for New England Chapter

The New England AIC Chapter announces that J. Horace Faull, Jr., 72 Fresh Pond Lane, Cambridge 38, Mass., has been chosen as chairman for the 1958 fiscal year, to succeed Dr. Eugene G. Rochow.

Will You Come

Feb. 4, 1958. Niagara Chapter dinner meeting. University of Buffalo, Norton Hall Cafeteria. 6:30 p.m. ($2.75). Meeting at 8:00. Speaker, Mr. Zudeck of Robert B. Warman, Inc. Subject, "Technical Writing—Aspects and Techniques."

Feb. 6, 1958. Louisiana Chapter meeting. Presentation of Honorary AIC Membership to Harold Levey. Dr. Henry B. Hass will present the certificate. For information: Mack F. Stansbury, So. Reg. Res. Lab., USDA, 1100 Robert E. Lee Blvd., New Orleans 19, La.

Feb. 11, 1958. Washington Chapter. Luncheon. 12:15 p.m. O'Donnell's Sea Grill, 1223 E St., N. W., Washington, D. C. Speaker: Dr. Per K. Frolich, Deputy Chief Chemical Officer for Scientific Activities, Department of the Army. Subject, "Management Problems in the Administration of Technical Programs."

Feb. 17, 1958. New York AIC Chapter with New York Section of American Chemical Society. Union Carbide Cafeteria, 30 E. 42nd St., New York 17, N. Y. Meeting to be at 7:30 p.m.

Speaker, W. E. Fairbanks, General Counsel, Thomas J. Lipton, Inc., Hoboken, N. J. Subject, "Chemists' Employment Agreements." For reservations, Fortuno De Angelis, F. D. Snell, Inc., 29 W. 15th St., New York, N. Y.

Feb. 18, 1958. AIC Board of Directors and National Council Meeting, The Chemists' Club, 52 E. 41st St., New York 17, N. Y. Board meets at 5:30 p.m.; Council at 6:00 p.m.

Feb. 18-20, 1958. Industrial & Science Conference & Fair. Memorial Auditorium, Buffalo, N. Y. Sponsored by Technical Societies Council of the Niagara Frontier.

Feb. 27, 1958. Alabama Chapter Meeting. Home Street Methodist Church, Huntsville, Alabama. Dinner: 7:00 p.m. Program 8:00 p.m. Speaker: J. Alston Branscomb, Leader, Analytical & Carbon Section, Reynolds Metals Co., Sheffield, Alabama. Subject, "What Management Expects of the Technical Man." For reservations: M. B. Williams, 402 E. Holmes St., Huntsville (JE. 2-8974), or Dr. C. E Feazel, Southern Research Institute, Birmingham (FA 4-2491).

Mar. 6, 1958. Twin City Chapter, joint meeting with the American Chemical Society, American Institute of Chemical Engineers, and Industrial Chemists' Forum, Town & Country Club, St. Paul, Minn. Dr. Otto Eisenschiml, F.A.I.C., Scientific Oil Compounding Co., Chicago, Ill., will speak on "Present Day Problems of Our Profession." For information: A. C. Holler, 3514 Taylor St., N. E., Minneapolis 23, Minn.

Mar. 11, 1958. New Jersey Chapter. Visit to Anheuser-Busch Brewery. Details to be announced.

Mar. 18, 1958. Washington Chapter. Honor Award Dinner. Dr. H. B. Hass will bring greetings from the National AIC.

Mar. 19, 1958. Baltimore Chapter Meeting. Speaker, Dr. Henry B. Hass, AIC president. Subject: "It's Your Institute."

Mar. 20, 1958. New England Chapter. Speaker, Dr. Henry B. Hass, AIC president. Subject, "It's Your Institute."

Mar. 27, 1958. Chicago Chapter. Speaker, Dr. Henry B. Hass, AIC president. Subject, "It's Your Institute."

Apr. 1, 1958. Niagara Chapter. Speaker, Dr. Henry B. Hass, AIC president. Subject, "It's Your Institute."

Apr. 3, 1958. New York Chapter. Young Chemists Meeting. Details to be announced.

April 10-11, 1958. Thirty-fifth Annual Meeting. THE AMERICAN INSTITUTE OF CHEMISTS. Ambassador Hotel, Los Angeles, California. Host: The Western Chapter.

May 13, 1958. New Jersey Chapter Honor Scroll Meeting. Program to be announced.

May 16, 1958. Twin City Chapter. Speaker, Dr. Henry B. Hass, AIC president. Subject, "It's Your Institute."

June 3, 1958. Niagara Chapter Meeting. Details to be announced.

June 4, 1958. New York Chapter. Annual Dinner Meeting and Honor Scroll Award. Details to be announced.

The Need for Prescience in Organic Chemistry

Dr. W. E. Hanford, Hon. AIC

Vice President, Olin-Mathieson Chemical Corp., 460 Park Ave., New York 22, N. Y.

(Presented when Dr. Hanford accepted Honorary AIC membership at a meeting of the New York Chapter at the Hotel Commodore, New York, N. Y., Dec. 12, 1957.)

THE thought I wish to convey in this title is the need to reach out ahead of our present knowledge of organic chemistry.

I quote from *Random Reminiscenses of Men and Events,* a book published in 1909 by John D. Rockefeller:

> "Probably the greatest single obstacle to progress and happiness of the American people lies in the willingness of so many men to invest their time and money in multiplying competitive industries instead of opening up new fields, and putting their money into lines of industry and development that are needed. It requires a better type of mind to seek and to support, or create, the new than to follow the worn path of accepted success, but here is the great advance in our still rapidly developing country."

Does this statement made nearly fifty years ago describe our 1957 research endeavors? Reworded, so as to reflect research rather than business, the statement would be:

> "Probably the greatest single obstacle to progress and happiness . . . lies in the willingness of so many *scientists* to invest their *energies* in multiplying competitive *projects* instead of opening up new fields and putting their *efforts* into lines of *research* and development that are needed. It requires a better type of mind to seek and to support, or create, the new than to follow the worn path of accepted success, but here is the great advance in our still rapidly developing country."

Much too much of our national research effort falls within this statement!

How can we get off the worn path of accepted success and open up new fields which will put our research and development efforts into lines that are so sorely needed? Many will say that these objectives can be obtained through *fundamental* or *basic* research. Webster defines "fundamental" as "of or pertaining to the foundation or basis." So neither of these words, fundamental or basic, convey any idea of expansion or newness.

What is the real purpose of fundamental research? To understand and organize known facts, or to reach out into the unknown? Let us speak of the limits of our knowledge as the "sphere of knowledge." Then the function of fundamental research is to improve the soundness, that is the base, on which this sphere rests. It goes one step further—it arranges the knowledge within the sphere in an orderly fashion.

Fundamental research is devoted to a better correlation and understanding of events and things which exist within our present sphere of knowledge. I shall differ with many by stating here that the new things asked

for by Rockefeller in 1909, by the management of our industries, and by the heads of our government, will not be obtained wholly through fundamental research. Some additional concepts are needed to expand our sphere of knowledge.

Before I discuss these additional concepts, I shall consider fundamental research and our universities. A part of this research can be done just where everyone wants it done, in the universities. We must have good correlation of the facts because the sciences are growing so rapidly that unless the facts are properly correlated we will not be able to comprehend our field. This is what ties the university professor to fundamental research. The job of a university is to train students within the sphere of existing knowledge so they can later use this knowledge for the creation of the new. The professor should develop concepts that will make it easier for the student to remember and correlate the vast amount of data in any science. When these concepts are developed, holes appear in the data which must be plugged up by experimental findings. This research is then done by the student as part of his training.

Some European universities have been successful in doing fundamental research and expanding our sphere of knowledge. Can this be done with our system? Dr. Roger Adams, twenty-five years ago, pointed out that under the European system the graduate student had to earn the right to do research by serving as an apprentice to the more advanced student. Thus the new students did the "prep" work and the more advanced students used these intermediates for the more advanced steps. Research was run like a Ford automobile factory. The students were *used* to produce the most efficient research rather than developed to the maximum. Thus it is possible for the European professor to work on problems that cannot be handled in our American universities. This system might be the best to develop a few really good men, but it is not the American system, where the broad education of the student is the prime consideration.

In the United States the student comes before fame for the professor. Problems have to be selected with the following objectives: (1) Will it teach the student how to use the literature and think in his field of science; (2) Will it teach him the skills of this profession, such as distillation, crystallization, etc. (3) When he obtains results will it allow him to practice interpreting these in line with theory; and (4) If he can do these things, does he have a chance of obtaining publishable results, a requirement for an advanced degree in most American universities. With these objectives, can we expect our professors to accomplish the same type of research that is done in Europe, or can we expect our universities to expand our sphere of knowledge?

I do not believe we can or should.

Let us look at another side of the professor's problem. He has a really brilliant idea; what kind of laboratory assistance does he have available to help him with the experimental evaluation of his idea? In industry we call his best finished product "green" Ph.D.'s, and recognize that it will take a couple of years to develop these into productive scientists. Our laboratory technicians know more about handling equipment than do the students on whom the professor has to depend for his experimental work. . . . Let us not forget that our universities are made up of professors and students, not professors and trained scientists.

We industrialists yell for fundamental knowledge because we want to expand our sphere of knowledge, but do not quite know how to do it. So we call to our professors for help. What we are really doing is "passing the buck." We are really praying that some underpaid professor will make a remark in one of his publications that will give us, but not our competition, that flash of genius necessary to build a new high-profit industry. Everybody hopes that the professor will not have sense enough to see the commercial importance of his work! So, let us support the professors who convey to our students what we already know; let us support their research, but let us not expect them to do the impossible, which is to teach students, correlate facts through fundamental research, and expand our sphere of knowledge at the same time.

Industry has a responsibility we like to shy away from. That is to make available to the universities the results of our researches, so the professors can teach the students all the known facts. Our big industrial and government laboratories are grinding out a tremendous amount of data. We must help the professors by making our results available to them.

It is apparent that we industrial scientists have an unassigned job. It is our responsibility to expand our sphere of knowledge. If we do not do it then let's not blame the industrialists, the politicians, or the university professors. . . . The public is demanding that we "put up or shut up!" So let us face up to it.

Having assigned the responsibility, we return to the concepts needed to expand our sphere of knowledge: First, a new measure of success, from which will develop the second factor, which is boldness. The third factor is prescience. Let us look at these factors.

(1) A new measure of success: In reviewing someone's work, or to emphasize how good someone is, we generally say he has X number of patents or publications. Is this the correct criterion by which to measure a man's contribution to science? It is relatively easy, if you are willing to work, to get X number of patents issued, or to have X number of articles pub-

lished. You can make a series of esters from some previously undescribed organic acids and a bunch of alcohols. You can make them by several techniques and end up with quite a few papers. Or you can simply measure the properties of a class of compounds and correlate the data with other properties. Obviously, an abundance of publications or patents does not mean that you have increased our sphere of scientific knowledge. We are not talking about filling up the holes in the sphere or putting a better base under it. We are talking only about making it larger. This can only be done when we start evaluating our own and our contemporaries' results by quality, not quantity or dollars spent. If scientists are willing to adopt this measure of success for themselves, it will be easy to sell industry and Government on its soundness. The Perkin Medal has been awarded to several men with less than ten patents or publications, and to others with over 150 patents or publications. But you could not credit any of these with more than two top contributions. Thank God for those few giants that can and have created many new things and concepts! Sometimes we tend to play down the scientist who has made only one major contribution by such statement as: "He was lucky," "What else has he ever published?" or, "He was just a flash in the pan."

(2) Boldness: The American has demonstrated that he will tackle any problem if the return is high enough. When the price of oil goes up, he goes in for more wild-catting. When a new ore is needed, he will go through hardships to find it. This same boldness, or spirit of adventure, will develop in our scientists when they know that the highest recognition will come to those who add the long appendage to our sphere of knowledge. The best illustration of boldness was the work on the atomic bomb. Fundamental research showed that it might be possible, but what made it great was the boldness of a few who were convinced it could work and then tried it.

(3) Prescience: To enter the field of prescience the worker must know his science. This basic knowledge will be obtained during his university years. As he leaves the university he is what we in industry call a "green" B.S., M.S., or Ph.D. If he stops at this phase in his learning he will never be qualified to carry out prescientific investigations. In his first years at industrial research, he must specialize and spend long hours studying and catching up with the literature covering his field. Having mastered a fair percentage of knowledge in a selected field, our young industrial scientist is ready to reach into the unknown. As he reaches out, he will have many fears and mental blocks as to whether his logic is sound; whether the goal is worth the effort, and whether he will ever get the results he wants. In his search in the

prescientific fields he will become discouraged because his reports will contain few positive data, and each will contain something like this: "I tried the following experiments with no success." Here he needs a lot of help to keep him at it. This is where the boss-man moves in by helping him over the rough spots.

My concept of the prescientific investigator is one who has his feet well embedded in our present sphere of knowledge and is reaching out into the unknown. So many think that if you are doing prescientific investigations you are just "mixing, messing, and muxing." Nothing could be further from the truth.

Of all the physical sciences, organic chemistry needs more prescientific investigation because our reaction mixtures are, in general, complex, and we are trying to cause one reaction to go in preference to several competitive reactions. Slight changes in the molecular structure often produce success or failure. Our organic chemists are a bit too conceited in thinking that everything is known and can be explained on the basis of steric hindrance, Sn theory, or resonance!

I am groping around in my effort to tell you how to do prescientific research. If I could define and classify it, it would be scientific research. We do not know everything, and some educated guess as to what is in the blue is needed. Having guessed what is out in the blue, be bold enough to seek it!

The basic way to do prescientific investigations is: Think. Plan. Conceive. Extrapolate. Look it up. If you can't find what you want, consider whether it would be worth doing if you could. If the answer is "yes", then try it. You can theorize till the cows come home, but organic chemistry is, and will be for a long time to come, an experimental science.

We scientists of 1958 are on the spot to produce new things. We cannot say that we must wait for a new generation of students who are taught the method to do it. We cannot leave it to any one group like the professors or the lone inventors, or the non-Americans, especially the Russians. We must do it. We will be successful in doing what the public demands of us, when we measure our work by quality, when we act boldly, and when we work with foresight.

Organic chemistry needs prescience and so does all of our American research. I am sure management is ready to accept it. Remember, it is easy to invent; it is difficult to invent something useful. Let us accept our responsibility and go to work. Let us make it not only useful but really novel, through prescience.

New Address: The New York Sales Office of Fischer & Porter Company of Hatboro, Pa., is now at 141 Main Ave., Clifton, N. J.

The Technical World of Hanford

Dr. Donald E. Sargent

Acting Manager, Organic Chemistry Section, General Electric Co., Schenectady, N. Y.

(Condensed paper, presented when Dr. W. E. Hanford received Honorary AIC Membership at a meeting of the New York AIC Chapter, December 12, 1957, in New York, N. Y.)

I FIRST met William Edward Hanford in 1941 when I was assigned to his group at the du Pont Experimental Station. He said simply, "We're working on the high pressure reactions of ethylene." Then he jotted down a few equations and handed me a slip of paper, "Why don't you let me know in the morning what you think of these?" That list included the direct synthesis of hexamethylene diamine from ethylene and hydrazine, the co-polymerization of ethylene and carbon dioxide and the use of symmetrical dibenzoyl hydrazine in place of benzoyl peroxide as an initiator for polyethylene. . . .

In the morning, I went to his office and said, "Dr. Hanford, I don't think all of these reactions are thermodynamically possible!" He said, "Let's get a couple of things straight. First, don't call me Dr. Hanford; my name is Butch! Second, the company made a million dollars last year on a thermodynamically impossible reaction. Let's try them anyway!" My academic naivete was blasted and I was introduced to the wonderful technical world of Hanford! We obtained only a trace of hexamethylene diamine, but we did succeed in copolymerizing ethylene and carbon dioxide, and dibenzoyl hydrazine turned out to be an extremely active catalyst for the high pressure polymerization of ethylene.

Butch grew up in Bristol, Pa. In 1926, he entered the Philadelphia College of Pharmacy, and with Prof. G. W. Perkins completed, in 1930, a senior thesis on the conversion of turpentine to camphor.

During 1930-31, Butch was on the analytical staff of Rohm & Haas. Then he went to the University of Illinois, where under the direction of Prof. Roger Adams, he really "caught fire."

In 1935, Butch became a member of Paul Salzburg's group at the du Pont Experimental station. He worked out a good synthesis for lauryl isothiocyanate. Then with Salzburg, he undertook a study of the reactions between nitriles, amines, and hydrogen sulfide to produce thioamides, and prepared the first fiber-forming polythioureas. He broadened the chemistry of the conversion of nitriles to thioamides.

The field of polyurethanes owes much to Butch. In 1936, he developed the first really good method for the preparation of long chain aliphatic isocyanates and diisocyanates. This was followed by the Hanford and Holmes "omnibus" polyurethane pat-

ent. Three other patents assigned to Hanford and Holmes cover further details of the use of long chain isocyanates for the treatment of cellulosic textiles.

In 1936, Butch was appointed group leader in the research area supervised by M. M. Brubaker. One team member was Dr. Richard S. Schreiber. Together they undertook an extensive study of the controlled, base-catalyzed, self-condensation of formaldehyde and acetaldehyde, and mixtures of aldehydes, to aldols capable of conversion to polyols by catalytic hydrogenation. Five patents were issued. Butch also holds one of the few operable patents on the simultaneous hydrogenation and hydrogenolysis of monosaccharides such as glucose to lower polyols.

By 1937, 6-6 nylon and related polyamides had been synthesized by Carothers and associates. Butch's group undertook work to extend this field. From this, came an understanding of how to utilize lower diamines in the preparation of super polyamides; how to utilize normally-cyclizing amino acids successfully; the preparation of soluble nylons from 12-amino stearic acid; phenol-modified polyamides, and finally, the successful method for the preparation of 6-nylon from caprolactam. With Martin, modified nylons were prepared; with Wiley an extensive study on the relationship between nylon structure and properties was completed.

Fawcett, Perrin, et al, discovered the high pressure polymerization of ethylene at I.C.I. in England in 1937. In 1938, du Pont undertook its further development. Brubacker conceived the possibility of polymerizing ethylene in typical emulsion systems like any other vinyl monomer, except at higher pressures, and assigned this task to Butch and his group. There followed an intensely active period in which much was learned about the polymerization, copolymerization and telomerization of ethylene and related monomers at high pressure. Patents assigned cover many variables in ethylene polymerization systems and the use of hydrazines as polymerization catalysts. The Hanford "omnibus" patent on ethylene copolymerization (U. S. Pat. No. 2,396,785) greatly extended the number of ethylene copolymers. Noteworthy also are the Hanford patents on the copolymerization of ethylene with carbon monoxide.

With Roland the copolymerization of ethylene with vinyl acetate, N-vinyl compounds, vinylidene chloride and vinyl chloride was investigated; and with Roland and Mochel the ethylene/vinyl pivalate copolymers; and with Wiley the copolymers of ethylene with the other lower olefins. With Salzburg, Butch covered the use of hypochlorites; with me, the use of N-chloro compounds as ethylene polymerization catalysts; with Roland and Young the use of lithium alkyls and aryls. The use of these lithium compounds was an early

demonstration of the usefulness of organo-metallics in ethylene polymerization.

Then through the observations of various group members, Harmon, Ford, Joyce, Roland, et al., it was realized that ethylene can react extensively with the polymerization media under certain conditions. Butch's group extensively developed the reactions between ethylene and related monomers and active halogen or hydrogen compounds to obtain high yields of low molecular weight intermediates. This process, known as "telomerization" was first described in U. S. Pat. No. 2,440,800.

The credit for the discovery of polytetrafluorethylene, or Teflon, belongs to Plunkett. But Butch and his group undertook a study of the purification and stabilization of tetrafluorethylene monomer and of methods of polymerization, copolymerization and telomerization. A paper by Joyce and Hanford, "Polytetrafluoroethylene" covers their pioneering work. Butch foresaw the possibility of copolymerizing tetrafluoroethylene with many other vinyl monomers and with other fluorolefins. He holds the patent covering vinyl fluoride-chlorotrifluoroethylene and with Ford the patent on poly-vinylidene fluoride. With Joyce the telomerization of TFE with telogens was extensively investigated. A paper written with Coffman, Raasch, Rigby and Barrick covers other reactions in this area. . . . This was by no means all the work in which he was engaged at du Pont until 1942.

In 1942, the government took over General Aniline & Film Corporation as an alien property. There was need to establish research and experimental facilities to provide supporting work which had formerly been carried out in Germany. Dr. W. Zimmerli, then of du Pont development department, was called upon to assist in establishing these new facilities under the Alien Property Custodian. He asked Butch to join G.A.F.'s new Central Research Laboratory in Easton, Pa. Butch inherited an empty silk mill and no staff nor equipment! It was his job to put together a modern laboratory. He accomplished something of a miracle in less than a year, and in 1943 the equipment and personnel of the Easton laboratory could be favorably compared with any industrial laboratory.

In 1945, Butch became research director at GAF. He managed about 125 technical people and a total staff of about 300. Research areas included acetylene chemistry, polymers, dyestuffs, surface active agents, photographic products and exploratory work. The intense patent activity and the number of technical papers produced in all of the fields of activity at the Easton laboratory testify to Butch's success as research director there.

In 1946, the late M. W. Kellogg invited Butch to join his company.

Starting as technical consultant, Butch was appointed director of petroleum and chemical research in 1948, and vice president, director of research, and a member of the board of directors in 1950.

At Kellogg, Butch directed activities that covered fluorocarbon polymers and elastomers, direct fluorination reactions, and many phases of petroleum research and hydrocarbon chemistry. Specifically, the further development of "Kel-F" chlorotrifluoroethylene polymers and elastomers and the experimental work which led to the first successful "Synthol" plant, now operating in South Africa, should be mentioned. Butch even found time to get his name on several Kellogg patents concerning the manufacture of hydrazine, the separation of alcohol from hydrocarbons, and the dehydration of aliphatic acids.

Butch has a new job! Last summer he joined Olin-Mathieson Chemical Corporation, where he is now vice president for research. In such a large, highly diversified, vigorous company, I am sure he will measure up to the great opportunities which lie before him.

This Unusual Man!

Dr. Richard S. Schreiber

Vice President for Scientific Administration, the Upjohn Company, Kalamazoo 99, Mich.

(Some excerpts from the author's introduction to the "Personal Side of Dr. W. E. Hanford".)

WHEN "Butch" Hanford received the Ph.D. degree at the University of Illinois in 1935, he was decidedly the most outstanding man of his class. As a member of that class, I can assure you that there is not one of us who did not admire and respect him.

Foremost among his characteristics is his devotion to science. Reading the scientific literature and working in the laboratory have always been real pleasures for Butch. To this day, the understanding of scientific matters is still his main hobby. Whenever he reads a scientific article or listens to a lecture, he must have pencil and paper handy to make notes, recording ideas and suggestions as they keep popping up in his fertile brain.

Butch is one of those rare individuals with a truly creative mind. He has a prodigious memory and is constantly probing it for bits of information which he might piece together with some new data that he has just acquired, to try to bring forth a new concept or a new approach to one of his unsolved problems. He has that rare ability of grasping the whole of a problem and going right to its heart. Tough problems are his meat; and like all good scientists, he is not easily

discouraged.

After joining the du Pont Company, his extraordinary ability was promptly recognized by his appointment as a group leader in the Chemical Department, after only one year of service.

Another one of his outstanding traits is his preoccupation with the goal once it has been set. Nothing will deter him from his efforts. . . . But one episode comes under the head of unfinished business: While the family was driving to Hartford, Conn., Butch's son, Bill, who is in prep school, asked Butch if he knew how to make rock candy. Butch told him it was easy. Bill said they were having a deuce of a time making it in class at school and wondered if he could show him how. When they arrived at the Statler Hotel, Butch and Bill steamed out to get sugar, containers, string, etc., to carry out this simple experiment. They soon returned loaded with supplies and went to work in the bathroom. After an hour or so of fussing around, they decided to allow the experiment to proceed under its own power, while they checked from time to time to follow the formation of the rock candy. Much to Butch's chagrin, the rock candy refused to make its appearance! Next morning, still no candy! It came time to check out, so the experiment had to be abandoned. Bill, however, has inherited his father's traits and does not give up easily, so a few days later when they were visiting at a chemistry professor's home in Princeton, this gentleman made the unfortunate mistake of discussing prep school matters with Bill. Almost immediately, Bill switched to the subject of rock candy! There was nothing to do but go out to the professor's kitchen and start the experiment up again. Lots of sugar, string, hot water, and fooling around in the kitchen all day long, but still no rock candy! I understand success still eludes Butch, but I am sure he will not give up until he has made some rock candy, even if he has to go to a rock candy factory to find out how it is done!

Although not outwardly a deeply religious person, Butch was given to studying the Bible during his youth, and his knowledge of that great document is indeed extensive.

Another one of Butch's outstanding traits is his ability to put himself in the other fellow's place, and he treats all of his fellow men with equal respect. He always has time for a word with the janitor and the laboratory boy as well as with his lieutenants and the research man in the laboratory. He is never one for a lot of polish, and he makes it clear where he stands on almost any matter—an extremely forthright individual. . . .

Leadership is another area in which Butch excels. Because of his admirable qualities, he has won for himself a whole host of friends. Butch certainly stands as a model for organic chemists in the industrial field.

Dr. Hass, Dr. Hanford, and Dr. Becker

Presentation to Dr. Hanford

Dr. William E. Hanford, vice president for research, Olin-Mathieson Chemical Corp., 460 Park Ave., New York 22, N. Y., received Honorary AIC Membership at a dinner meeting sponsored by the New York AIC Chapter, December 12, 1957, at the Hotel Commodore, New York, N. Y. A reception to the medalist was sponsored by Olin-Mathieson Corporation preceding the dinner.

The chairman of the Chapter, Dr. Ernest I. Becker of Polytechnic Institute of Brooklyn, presided. Honorary Chairman of the meeting was Dr. Roger Adams, Hon. AIC, professor of organic chemistry, University of Illinois.

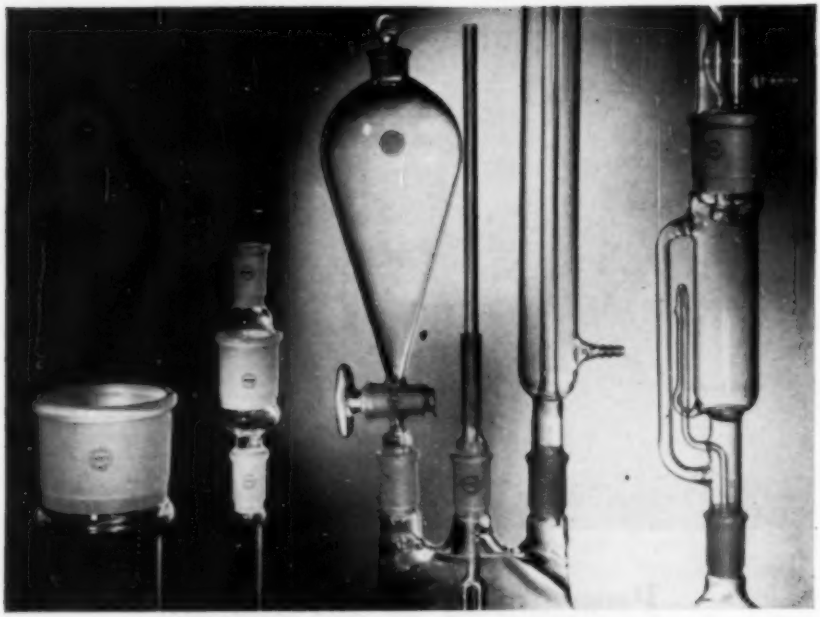
Dr. Hanford was introduced by Dr. Donald E. Sargent, acting manager, Organic Chemistry Section, General Electric Company, and Dr. Richard S. Schreiber, vice President for Scientific Administration, Upjohn Company.

Dr. Henry B. Hass, AIC president and president of the Sugar Research Foundation, presented the certificate of Honorary membership to Dr. Hanford, who responded with an address on "The Need for Prescience in Organic Chemistry." (The papers presented are on preceding pages of this issue of THE CHEMIST.)

The citation to Dr. Hanford reads:

To William Edward Hanford

Distinguished organic research worker in the field of high polymers; competent research executive and leader, with a deep interest in the individual workers who hold him high in their esteem and affections; a dedicated promoter of professional ideals.



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Understanding the Creative Process

Dr. Maurice J. Kelley, F.A.I.C.

Director, Industrial Specialties Laboratories, Nopco Chemical Co., Harrison, N. J.

(This is Part IV of a series which started in the November, 1957 CHEMIST)

Part IV. The Creative Thinking Process

THE literature surveyed as background for this paper reveals at least sixteen different lists of the stages or phases of the creative thinking process. Below are shown the lists of four prominent authors.

Hutchinson[1]—**Preparation, Frustration, Moment of Insight, Verification.**

Osborn[2]—**Orientation, Preparation, analysis, Hypothesis, Incubation, Synthesis, Verification.**

Ott[3]—**Problem, Preparation, Frustration, Incubation, Insight, Verification, Communication.**

Sharp[4]—**Recognition, Decision, Preparation, Search for Clues, Frustration, Insight, Action.**

This writer has chosen to use the Ott scheme, and Table 8 describes each of the stages in some detail.

TABLE 8

Stages in Creative Thinking Process

Problem: *The* ***real*** *problem must be clearly understood, with its environment and its true limitations.*

Preparation: *Obtain all existing knowledge bearing on the problem. Rearrange ideas, imagine further data, mentally construct possible solutions. Completely immerse one's self in the problem.*

Frustration: *This happens when no solution emerges. Do not be dismayed, as frustration is a prelude to insight.*

Incubation:—*Set problem aside for other work or, better, relaxation; recreation is good; sleep is even better.*

Insight: *In a "flash" the answer comes; we* ***know*** *it is right.*

Verification: *The solution is tested in a practical way.*

Communication: *The idea must be "sold" to others, to produce benefits.*

It must be borne in mind that not all the stages need occur, and not necessarily in the same order. Even insight, which is the highest form of creativity, need not always occur. Some problems remain unsolved, others are solved by purely logical processes. But we need to know as much as possible about this creative process business, so that on the problems which really need insight we will be better able to bring on the "miracle" of insight.

The extent in time required by the various stages can vary widely, and can be a matter of years for the first two stages—problem and preparation. Insight occurs in a moment, frustration should be stopped as soon as it has set in, and incubation should not exceed a day or two in most cases without returning to the preparation stage.

Problems sometimes are easily discovered, other times must be deliberately sought out, and still other times are thrust upon us. Very often, the most critical stage in the entire chain

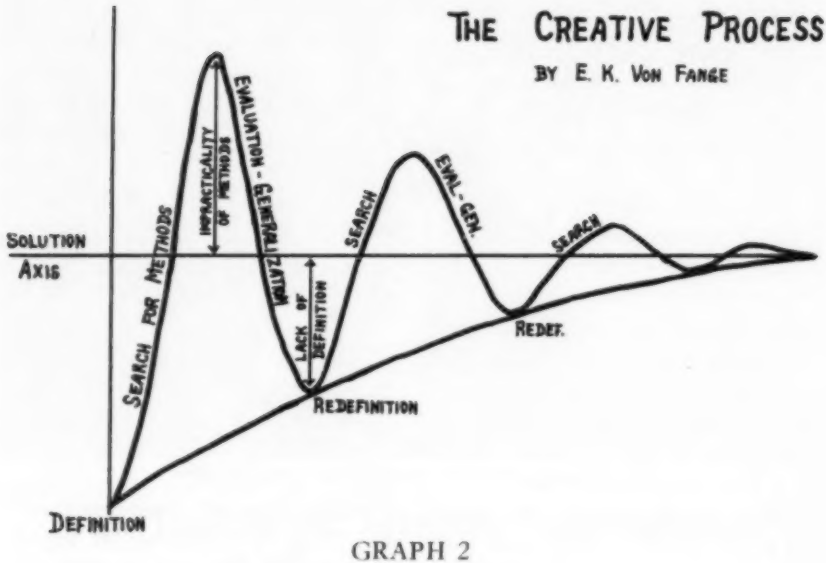
1. Hutchinson, Eliot Dole. "How to Think Creatively." Book: Abingdon-Cokesbury, Nashville. (1949).
2. Osborn, Alex F. "Applied Imagination—Principle and Procedures of Creative Thinking." Book: Chas. Scribner's Sons, New York (1953).
3. Ott, Emil. "Stimulating Creativity in Research." Chem. Eng. News **33**, 2318-21, 1955.
4. Sharp, H. T. "Here's How to Get Ideas in a Hurry." Chem. Eng. **63**, 218+ (July) 1956.

of events in creativity is the definition of the problem—the real problem. John Dewey has said, "A problem well stated is half solved." If the problem is too complex or vaguely defined, narrow it down to something specific. Kettering says, "Pull the problem apart; you will find many elements you already know about, as well as those you don't know about." It is well to remember that a given problem and its objective may, in the course of work on it, lead to a different objective and solution. Also, do not be dismayed at the seeming enormity of the problem, nor of its cool reception by others. Alfred North Whitehead, the great American psychologist and educator, said, "All truly great ideas seem absurd when first proposed."

Some differences of opinion exist as to how thorough the preparation should be, but analyzing the background information and what is learned by work during this stage is a great spur to the imagination. Von Fange cites as a type of block to creativity the refusal to review prior art (from which much could be learned) for fear of prejudicing opinions and experiments to be performed. A keen memory and sharp powers of imagery help greatly in handling the multitude of facts and rearranging them. And it is to aid the generation of ideas at this preparation stage that the techniques to be described in Section VI were developed. James R. Killian of M.I.T. opines that the most alleged startling discoveries were really preceded by years of work. It is this stage of preparation (and analysis, hypothesis, etc., if you will) in which we must exert the tremendous energies which are counselled throughout this paper and by all authorities on creativity.

We should realize that frustration is quite normal, and almost essential, while spending one's self so completely in the preparation stage. When frustration does set in, it is imperative that we go on to the next stage, incubation; that we rest the mind, either by a lighter type of non-creative work, or by literally relaxing. At least two U. S. firms now recognize this fact to the extent of encouraging their researchers to go home, when they experience the jaded feeling of frustration after intense work. Of course, the incubation stage can become too enjoyable, and must not be overdone!

Actually, it may be necessary to back track; to take a fresh look at the definition of the problem, to reanalyze the data in hand, and to seek



GRAPH 2

creatively a new clue to the main problem. Osborn has this to say, "We rarely follow such a 1-2-3 sequence. We may start guessing while we are still preparing. Our analysis may lead us straight to the solution. After incubation we may again go digging for facts which, at the start, we did not know we needed." Van Fange[5] pictures this backing and filling in Graph 2.

The importance of hard work (preparation) and the reality of insight have been attested to by numberless creative geniuses. Said Irving Langmuir, "The final solution . . . of almost all problems . . . comes to mind by a process which is not consciously one of reason." "Insight", says Dr. Eliot Dole Hutchinson, "is one of the most recurring facts of creative life, supported by more evidence than almost any other aspect of the creative mind".[6] Many of the great thinkers had special ways of inducing insight; such as an early morning hike, to commune with nature, periods of deliberate silence and meditation, listening to music, and even shining shoes!

Edison said he got ideas "out of the air", and Henry Ford said of ideas, "The air is full of them; they are knocking on your head, and you don't have to think about them too much." However, most authorities

5. Von Fange, E. K. "Understanding the Creative Process". Gen. Elec. Rev. **58**, 54-7 (July) 1955.

6. Danzig, Elliott R. "The Creative Thinking Process." The Chemist **30**, 525-28, 1953.

agree that, to gain insight, one must "be on the hunt." The creative person knows, as William Easton said of inspiration, to "go where you are most likely to find it; expect to find it, if you strive hard enough."

Many people trust their first (more apt to be intuitive) impressions more than their later checks. Louis Bromfield said, "I trust my inner mind over any judgment arrived at by long and conscious reasoning."

Try to develop a dual personality —watch yourself as you are engaged in creative problem-solving. Observe what procedures worked well for you, and what were not so successful. This will help you to improve your technique. And remember that, as Arnold has said, the creative process doesn't end with an idea, it only starts with an idea. There is a lot of work and further creativeness required between the initial solution idea and the final tangible end-result.

Having mentally pictured the answer to a creative problem, it is necessary to test the solution in a practical way. And then, it is necessary to act, for as Charles H. Clark of Ethyl Corporation says, "Unless you act on your ideas, nothing is going to happen".[7] The idea must be "sold" to the boss and followed through, as Pleuthner says, "until you have something you can sell to the public for money".[8]

(Part V, "The Stimulation of Creativity" will appear in the March *Chemist*).

7. Bittel, Lester R. "How to Make Good Ideas Come Easy." Factory Mgmt. **114**, 84-90 (Mar.) 1956.
8. Pleuthner, Willard. "Brainstorming: A Method for Developing Creative Engineering Ideas." Machine Design **28**, Jan. 12, 92-4, 1956.

Nopco Chemical Company, Harrison, N. J., is celebrating its fiftieth anniversary. Founded in 1907 by Charles P. Gulick and Arthur Philips, with an investment of $1,000, it is currently grossing 28-million dollars.

Dr. Fisher, Dr. Beckman, and Mr. Webber

The Builder of Intricate Instruments

Dr. Harry L. Fisher, Hon. AIC

4116 *Santo Tomas Drive, Los Angeles 8, California*

(Presented when Dr. A. O. Beckman received Honorary AIC Membership at a meeting of the Western AIC Chapter, at the Turf Club Restaurant, Los Angeles, Calif., Nov. 19, 1957.)

DR. ARNOLD ORVILLE BECKMAN was born in Cullom, Illinois, fifty-seven years ago. He had his undergraduate education at the University of Illinois, where he was graduated in 1922 with the degree of B.S. in chemical engineering. He spent the following year there and received the degree of M.S. in physical chemistry. He then changed his location and was a teaching fellow, 1923-24, at California Institute of Technology.

After that year, he journeyed, via the Panama Canal, to New York, and for two years, was a research associate with Dr. Walter A. Shewhart in the Bell Telephone Laboratories. He then jumped across the country again, returning to California Institute of Technology, where he was an instructor in physical chemistry, and was awarded the degree of Ph.D. in photochemistry, in 1928. He was an assistant professor there from 1928 to 1940.

During the latter part of his teaching career, he began to devise intricate and practical instruments *par excellence* for scientific analytical and process control work, and he was the founder and vice-president, then president, 1939, of National Technical Laboratories, South Pasadena, Cali-

fornia. This firm is now Beckman Instruments, Inc., manufacturers of pH meters and spectrophotometers. In 1944 he founded and became president of Helipot Corporation, manufacturers of precision multi-turn potentiometers which are known as "Helipots." In 1946, he also founded and has been president of Arnold O. Beckman, manufacturers of oxygen analyzers and gamma ray dosimeters. That is a remarkable record!

Yet in spite of these enterprises, he does much to help others. He is a trustee of Cal. Inst. of Technology and of the Southern California Air Pollution Foundation. He was president of the Los Angeles Chamber of Commerce, and a director of the California State Chamber of Commerce. He was president of the Instrument Society of America in 1952. He is a member of the American Chemical Society, the Electrochemical Society, American Association for the Advancement of Science, and American Society for Testing Materials. He is also a member of Delta Upsilon, Sigma Xi, Alpha Chi Sigma, and Phi Lambda Upsilon. His clubs are Oneonta, Athenaem, Altadena Country, Jonathan, and Newport Yacht Club.

While in New York, June 10, 1925, he was married to Mabel Stone Meinzer. They have two children, Gloria Patricia and Arnold S.

He is a man who hitched his wagon to a star, far and away beyond Sputniks I and II!

(See January *Chemist* for presentation to Dr. Beckman).

Communications

Schools Can Supply Needed Scientists

To the Editor:

Some friend was kind enough to send me the May issue of THE CHEMIST along with some reprints of discussions by Dr. Joel Hildebrand. I have read these with a good deal of interest and found them highly stimulating. As I read them, I was reminded of a quotation which he used, which was made by Dr. William H. Kilpatrick in the 1930's, in which he refers to the idea that a number of people do not use arithmetic and therefore have little need for it. At that particular time, I also recall that there was little need for engineers, scientists, and mathematicians in this country of ours. I wonder if you would look back in the issue of your magazines from 1934 to 1939, if you would find any article printed therein which would encourage young people to go into the field of chemistry?

During those years I was working in the middle west and southern states. Many chemistry houses had closed their doors. Many of the industries had cut down to the point where properties were resting idle. My point is that we are prone to interpret education of our children and condition in terms of the present. That we should do. I think it is grossly unfair and unwise to make quotations such as the following: In the period between 1929 and 1940 there was no need for chemists, as indicated in the literature, by chemical institutions. Therefore, in 1957 and 1958 there is likewise no need for chemists!

In the two high schools over which I have some supervision, we have a number of science teachers who are well enough trained to go into industry without any difficulty whatever and receive much more compensation than they are getting in this school system. They, however, like to teach and are dedicated to the service of helping young men carry on into the areas of science. Because of this we have been able to offer two courses in our senior high schools in the field of chemistry, the second course being comparable to that offered in the freshman and sophomore years of colleges and some universities. We have these offerings for those that have some aptitude in the areas of science.

I have spent seven years in formalized teacher education and administration work. My first major for my master's degree was in the area of philosophy of education. If I interpret John Dewey's philosophy correctly, he meant just this. He meant that it was our responsibility to help the child to grow and develop to the greatest potential possible. I well remember a quotation from Thomas Briggs, "It is the first duty of the

school to teach pupils to do better the desirable things that they are likely to do otherwise—the second duty of the school is to reveal higher activities and make these both desired to the extent possible." In following this principle, which is fundamental to differentiation of education, we are placing into our high schools and into our elementary courses some advanced work. We are making them attractive to the point that they are desirable, and we are carrying them to the extent possible.

I would be the first to admit that this is not uniformly accepted by my colleagues, nor do I feel that we have gone to the limit any more than I feel that the chemists in the field of chemistry have exhausted the subject to its fullest potential.

It seems that the American public is in a state of frustration at the present time, that they are looking somewhere to point fingers. No one will produce chemicals that will be of aid and assistance to mankind unless mankind will put them to use. If the demand is there, we are ingenious enough to see that it is supplied. Likewise, it is true that if we can find a place in our society to put well trained pupils from our schools where they can make contributions, I assure you that the American public school is in a position to supply in adequate numbers all that the demand will warrant.

—Leslie W. Johnson,
Superintendent of Schools,
Sheboygan, Wisconsin.

Inventorship

To the Editor:

In reply to Dr. Eduard Farber's letter (THE CHEMIST, Nov. 1957), it is indeed true that the law requires a sworn statement of inventorship.

However, Rule 45 and Rule 324 of the Rules of Practice permit sole inventors to join with others to form joint inventorship, and it also permits joint inventors to delete one or more co-inventors, and this is true even if the patent has issued.

Thus it is possible to have a sole inventor swear on filing that he is the sole inventor. Later the sole inventor can swear he is not the sole inventor but a joint inventor with X. Later after the patent has issued, it is conceivable that X may not be a co-inventor so that after more swearing under oath the sole inventor returns to his original status.

Thus after much swearing, all under oath, the cyclical is made and the original sole inventor returns to his original status.

In fact, if in the patent application a statement is made that the data presented is critical, the Patent Office disregards the fact that this data is presented under a sworn statement and requires Proof of Criticality (i.e. Affidavits). But no proof of inventorship is required by the Patent Office.

It may be that the Patent Office should require Proof of Inventorship, but this raises many questions, for the claims which define the invention as allowed (if the application is allowed) are often wholly different from the definition of the invention presented in the claims as originally filed.

—Dr. Frank Makara, F.A.I.C.

On Confidential Relationship

To the Editor:

In your January issue, Dr. Makara submitted a note mentioning that "the Patent Office has ruled that there is no confidential relationship between an employee lawyer (patent attorney) and his employer (the corporation)." I do not quite understand what he meant by the statement, but I would like to refer to the case of Georgia Pacific Plywood Co. v. United States Plywood Corp., 108 USPQ 294, in which Judge Kaufman of the New York District Court recently held that privilege exists in such cases as to communications relating to counsel's participation in patent litigation.

—Peter J. Gaylor, F.A.I.C.
Elizabeth, N. J.

The Society of Applied Spectroscopy will meet March 18th at the Philadelphia College of Pharmacy and Science Cafeteria, Philadelphia. Speaker: N. B. Hanney of Bell Telephone Labs. Inc. Subject: "Mass Spectroscopy of Solids."

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Highlights of the October Meeting

The 317th meeting of the National AIC Council was held October 15, 1957, at 6:00 p.m., at The Chemists' Club, New York 17, N. Y., with President Henry B. Hass presiding. The following officers and councilors, or alternates, were present: Max Bender, M. Berdick, R. P. Dinsmore, A. W. Fisher, Jr., D. M. Gans, L. A. Hall, H. B. Hass, F. A. Hessel, D. B. Keyes, J. H. Nair, Emil Ott, A. F. Parks, H. Robinette, Jr., G. L. Royer, G. H. Taft, L. Van Doren, and M. B. Williams. Dr. C. L. Brown, chairman, Committee on Professional Education, and V. F. Kimball, were present.

Dr. Harry L. Fisher, Hon. AIC, national councilor and former AIC president, was appointed to present Honorary AIC Membership to Dr. A. O. Beckman, at ceremonies to be held by the Western Chapter in November, in Los Angeles, Calif.

New Directory

The Committee appointed to consider the publication of the new directory reported, and it was decided to publish the Directory in the April, 1958, issue of THE CHEMIST.

The Professional Way

The Treasurer reported a number of persons in arrears in dues. During discussion, it was pointed out that professional status is not confined to the attitude of others to members of a profession, but that it also implies a manner of personal behavior. Professional chemists should never permit themselves to be dropped for failure to pay dues to an organization. If a professional person wishes to discontinue membership, he should resign at the termination of the membership year. If he wishes to continue membership, but is in financial emergency, he should state his position to the secretary so that arrangements can be made to carry him to a more favorable time. Where dues are merely overlooked accidentally, the usual follow-up notice from the secretary's office should suffice as a reminder.

Dr. Dinsmore stated that normally only about 15 per cent of all chemists and chemical engineers are interested in the intangibles of professional status. These are the persons who work to elevate the status of the whole profession. Industrialists would quickly create a better professional climate for scientists, if they understood the value to business in terms of profits which such a favorable climate brings, through the increased productivity of scientists and the high quality of the scientific people attracted.

Dr. A. W. Fisher, a member of the Qualifications Committee, stated that election to AIC Fellowship requires professional interest and activity in addition to education and technical experience. The AIC welcomes those qualified chemists who think seriously about professional matters and who are willing to help others. The AIC is a place where its members can have ideals and where they can exchange their views on professional matters.

The president was authorized to appoint a Policy Committee to consider the objectives of the AIC with recommendations for implementing them.

In Memory

The secretary reported with deep regret the deaths of the following members:

Col. G. A. Burrell, F.A.I.C., Aug. 16, 1957.

Charles C. Concannon, Life Member, Aug. 10, 1957.

Dr. Lawrence T. Fairhall, F.A.I.C., June 17, 1957.

Jacob C. Goldstein, F.A.I.C., Oct. 31, 1956.

Morris Katzman, F.A.I.C., Aug. 29, 1957.

Dr. Roy H. Kienle, F.A.I.C., Sept. 2, 1957.

Dr. William Krumbhaar, F.A.I.C., Aug. 26, 1957.

Arthur A. Lieberman, F.A.I.C., Mar. 31, 1957.

Joseph R. Minevitch, Charter Member, July 3, 1957.

Julius F. Rudd, F.A.I.C., Aug. 12, 1957.

Dr. Gilbert B. L. Smith, F.A.I.C., Aug. 29, 1957.

Final Report—1957 Meeting

The Treasurer presented the financial report of the 1957 Annual Meeting, prepared by Dale F. Behney, Treasurer of the Meeting, and the Council expressed its appreciation to the Ohio Chapter for the fine way in which the financial matters of that meeting had been handled.

Civil Service Classification

Mr. Parks reported that the Washington Chapter is maintaining watchful and helpful interest in attempts to remove scientists from the General Service Category of the Civil Service to give them a professional rating, if possible.

Emeritus Members

Emeritus membership was conferred on the following Fellows:

Eugene F. Cayo.
Col. Harry L. Cole.
Alexander G. Keller, Jr.
Robert H. Stevens.
Lester Yoder.

Delegates to the AAAS

The Secretary announced that the following alternate delegates were appointed to represent the AIC in the AAAS: O. B. J. Fraser and John Nair. Dr. Emil Ott and Dr. Van Doren are the current delegates.

Chapter Reports

Dr. Hall reported that the Chicago Chapter had an excellent Honor Scroll award meeting, October 10th, and that there is much interest in programs on professional status.

Dr. Berdick reported that the New York Chapter met October 3rd to hear a discussion on "Management Evaluates The Chemist." Speakers were Prof. Ernest Dale and Philip R. Kelly. On November 7th it will meet with the CIA, with Dr. Ernest Hart as speaker. Honorary AIC Membership will be presented to Dr. W. E. Hanford, December 12th.

Mr. Taft stated that the New England Chapter Honor Scroll award would be presented in January. A joint meeting is scheduled with the ACS for October, 1958. The new Secretary-Treasurer of the Chapter is Dr. Albert E. Frost, Jr.

Mr. Robinette stated that the Pennsylvania Chapter met October 3rd to hear Dr. R. Graeme Smith speak on problems related to small business. The Honor Scroll will be given to Dr. Glenn E. Ullyot on January 9th.

Mr. Williams reported that the Alabama Chapter held meetings in June, July, and August. Dr. Charles R. Scott, professor of industrial management, University of Alabama, will speak in October. The Chapter has secured twenty-four new applications

for membership.

Mr. Gans reported that the Ohio Chapter will meet October 30th in Columbus.

Mr. Parks stated that the Washington Chapter holds regular luncheon meetings, and will hold an Annual Award dinner in March.

Dr. Bender reported that the New Jersey Chapter has held regular meetings, and that its professional advisory committee is active.

Elections

The following new members were elected:

FELLOWS

Albrecht, John R.
Expediter, Miller Lumber Company, Miller & Company, Selma, Alabama.

Burns, Thomas H.
Technical Director, Central Foundry Company, Holt, Alabama.

Creitz, Ellis E.
U. S. Bureau of Mines, P. O. Box L, University, Alabama.

Ganz, A. Jerome
Food Technologist, Hercules Power Company, Hercules Experimental Station, Wilmington, Delaware.

Hatcher, Abram W.
Patent Coordinator, Thiokol Chemical Corps., Redstone Division, Huntsville, Alabama.

Hinken, Lawrence R.
Chemstrand Corporation, Courtland Highway, Decatur, Alabama.

Hisey, Dr. Alan
Associate Professor, Chemistry Dept., University of Alabama, University, Alabama.

Jernigan, John M.
President & Chairman of the Board, Southern Pine Chemicals, Inc., 2503 Greensboro Avenue, Tuscaloosa, Alabama.

Kunik, I. Jordan
Patent Lawyer, 521 Fifth Avenue, New York 17, New York.

Marrero, Dr. Emilio J.
General Practice, Medicine & Surgery, Jay Clinic, Jay, Florida.

Miner, Dr. Robert S., Jr.
Manufacturing Chemist, Ciba Pharmaceutical Products, Inc., Hegenheimerstrasse 9, Basel, Switzerland.

Nelson, Raymond A.
Alcohol & Tobacco Tax Lab., Internal Revenue Service, 10th and Pennsylvania Avenue, Washington 25, D. C.

Orem, H. Philip
United States Pipe & Foundry Company, 3500 35th Avenue, North, Birmingham, Alabama.

Raeuber, Arthur E., Jr.
Southern Research Institute, 2000 Ninth Avenue, South, Birmingham 5, Alabama.

Saltman, Dr. William M.
Senior Chemist, Goodyear Tire & Rubber Company, Research Bldg., Akron 16, Ohio.

Sayward, John M.
Director, Vermont Bureau of Industrial Research, Norwich University, Northfield, Vermont.

Schaller, William H.
United States Chemist (field), Alcohol Tax & Narcotic Bureau, 1521 Post Office Bldg., St. Paul 1, Minnesota.

Shaffer, Arthur H.
Assistant Chief Chemist, U. S. Internal Revenue Service, Chicago Regional Laboratory, Room 725 Main Post Office Bldg., Chicago 7, Illinois.

Shaw, Carlton W.
Owner and Operator, Shaw Laboratories, P. O. Box 167, Ft. Lauderdale, Florida.

Shuman, Dr. A. Cornwell
President, Shuman Chemical Laboratory, Inc., Box 543, West Lafayette, Indiana.

Smith, Julian C.
Professor, Cornell University, Olin Hall, Ithaca, New York.

Southern, Dr. John A.
Chairman, Dept. of Chemistry, Howard College, Birmingham, Alabama.

Stern, Dr. Joel R.
Children's Memorial Hospital, 707 Fullerton Avenue, Chicago 14, Illinois.

Stevenson, Dr. Arthur C.
Assistant Director, Elastomers Laboratory, E. I. duPont de Nemours & Company, P. O. Box 406, Wilmington, Delaware.

Swakon, Dr. Edward A.
Standard Oil Co. of Indiana, Research Dept., P. O. Box 431, Whiting, Indiana.

Thompson, H. Leroy
Independent Consulting Chemical Engineer, 329 Brown-Marx Bldg., Birmingham 3, Alabama.

MEMBERS

Alley, Bernard J.
Chemist, Materials Laboratory, Rocket Development Labs., Redstone Arsenal, Huntsville, Alabama.

Engelbach, Thomas J.
Borne Chemical Company, Inc., 632 South Front Street, Elizabeth, New Jersey.

Farren, Ann L.
American Chemical Society, News Service, 2 Park Avenue, Room 1802, New York 16, New York.

Lamb, James B.
Chemist, Dodge & Olcott, Inc., 180 Varick Street, New York 14, New York.

McCutcheon, George F., Jr.
Director, Quality Control, S. B. Penick & Company, New York & Grant Avenues, Lyndhurst, New Jersey.

Poetz, Matthias B., Jr.
Chief Chemist Analyst, Chemical Control Dept., Gillette Company, Toni Division, 332 Rosabel Street, St. Paul 1, Minnesota.

Smith, Josiah E., Jr.
Southern Research Institute, 2000 9th Avenue, South, Birmingham 5, Alabama.

Smythe, Russell B.
E. I. duPont de Nemours & Company, Charlestown, Indiana.

Stewart, Dr. A. Theodore, Jr.
Special Weapons Unit, Pacific, Naval Air Station, North Island, San Diego 35, California.

Van Sickle, Ferris H.
Analytical Chemist, Bureau of Internal Revenue, Alcohol & Tobacco Tax, 1521 Main Post Office Bldg., St. Paul 1, Minnesota.

Williams, Charles F.
Control Engineer, Thiokol Chemical Corporation, Redstone Division, Redstone Arsenal (B500), Huntsville, Alabama.

Wilson, Oliver G.
Research Chemist, Newport Industries Company, Inc., P. O. Drawer 911, Pensacola, Florida.

ASSOCIATES

Hand, Joseph C., Jr.
Redstone Arsenal, Research & Development Lab., Materials Lab., Chem. Br., Exploration Section, Huntsville, Alabama.

McCauley, Rogers C., Jr.
Chemical Engineer, Thiokol Chemical Corporation, Redstone Arsenal, Huntsville, Alabama.

Mulich, Stephen F., Jr.
Materials Laboratory of Rocket Development Lab., Room 223D, Bldg. A-120, Mat. Lab., RDL, Redstone Arsenal, Huntsville, Alabama.

Phillips, Joshua
1558 East 29th Street, Brooklyn 29, New York,

Zerlaut, Gene A.
(US 55 557 196). *Research Chemist,* U. S. Army Ballistic Missile Agency, Bldg. 251, General Chemical Unit, Huntsville, Alabama.

RAISED FROM FELLOW TO LIFE MEMBER

Yamins, Jacob L.
Assistant to the President, National Dairy Research Laboratories, Inc., Oakdale, L. I., N. Y.

RAISED FROM MEMBER TO FELLOW

Sausville, Dr. Joseph W.
Chief, Materials Div., Nuclear Power Dept., Research Div., Curtiss-Wright Corp., Quehanna, Penna.

Turner, Wendell P., Jr.
Chief, Plants Branch, Engineering Div., Operations & Research Group, U. S. Army Chemical Corps, Bldg. 483, Army Chemical Center, Maryland.

REINSTATED AS A MEMBER

Pinigis, Edwin J.
Technical Supervisor, Pennsylvania Salt Mfg. Company of Washington, Bryan, Texas.

REINSTATED AS AN ASSOCIATE

Taylor, Lloyd D.
54 Cedar Street, Everett 49, Massachusetts.

For Your Library

Energetics in Biochemical Reactions

By I. M. Klotz. Academic Press, Inc. 1957. 64 *pp.* 8¼″x5¾″. $3.00.

The object of energetics or thermodynamics is to establish the principles which govern material changes. The author shows how the axioms of each of the branches of energetics may be delineated and how some of the theorems may be developed from these axioms. Some of the ideas are applied to biochemical problems.

—Dr. Henry Tauber, F.A.I.C.

The Chemistry of Petrochemicals

By Melvin J. Astle, Reinhold Publishing Corp. 1956. 267 *pp.* 9½″x6″, $6.50.

Dr. Astle, professor of organic chemistry at Case Institute of Technology, formerly chief chemist at the Martinez, California, plant of Shell Chemical Co., brings to his subject practical experiences as well as knowledge of theory. He shows the importance of petroleum as a chemical intermediate, rather than as a fuel, and discusses the chemistry involved in the conversion of petroleum hydrocarbons into commercially useful chemicals. He explains methods for the preparation of petrochemicals, including reaction conditions, types of catalysts used, and special equipment. This book is a must for anyone interested in the development of new commercial petrochemical products.

—Dr. Frederick A. Hessel, F.A.I.C.

Chemical Books Abroad

By Dr. Rudolph Seiden, F.A.I.C.

Walter de Gruyter & Co., Berlin W 35: *Stoechiometrische Aufgabensammlung,* by W. Bahrdt and R. Scheer; 6th ed., 118 p.p.; paperbound DM 2.40. A well-organized collection of stoichiometric problems.

Verlag Technik, Berlin W 8: *Einfuehrung in die Chemie der Komplexverbindungen, by* A. A. Grinberg; 390 pp (31 ill., 27 tables); DM 23.—The author received the Stalin Prize for this textbook of the chemistry of the complex compounds. He gives a sound introduction to the field, with emphasis on physical-chemical viewpoints, covering the complex compounds consisting of metal salts with N-,O- and S-containing components; double salts; polyhalides, polysulfides and polyacids. • *Metallurgie des Aluminiums, Vol. II,* by A. I. Beljajew, M. B. Rapaport, and L. A. Firsanowa; 1957, 300 pp.; DM 27.50.—This volume concludes the Russian experts' work on Al. It is a clear and comprehensive treatment of both theory and practice of the electrolytic refining of Al and the electrothermics of Al and its alloys.

Leonard Hill Ltd., London NW 1: *Food Industries Manual;* 18th ed.; 1039 pp.; 65 sh.—This standard reference work has been compiled by 15 food experts and the staff of the journal "Food Manufacture." It is unique in its coverage of the whole field of modern food technology. The main chapters of this invaluable handbook deal with flour; confectionery; fruit juices; canning; meat products; dairy products; fats; food dehydration; refrigeration; equipment; etc. An extensive index and a buyer's guide conclude the manual.

Ferdinand Enke Verlag, Stuttgart W: *Kuenstliche organische Farbstoffe und ihre Anwendungen,* by W. Seidenfaden; 1957, 263 pp.; DM 44.50.—A truly comprehensive treatment of the chemistry of the synthetic dyes and their uses, particularly in the textile industry; with many historical and literature references, but without too much consideration of patents or other than German ("I. G.") commercial names of the dyestuffs.

Urania-Verlag, Leipzig: *Anwendung der Atomenergie fuer friedliche Zwecke;* 1956, 160 pp.; DM 4.80.—A timely subject: the peaceful uses of atomic energy and its important influences upon the economy and science of future generations are here discussed by 14 Russian atomic scientists. They predict great progress for the chemical and food industries, machine building, plant research, biology, metallurgy, agriculture, and medicine.

Editio Cantor, Aulendorf/Wuertt.: *Rote Liste* 1957; 872 pp.; DM 12.—In enlarged size, the 1957 ed. of this biannual standard work (See "THE CHEMIST", January 1955) describes in alphabetical order 5900 specialties (manufactured by the members of the association of the German pharmaceutical industry), giving their indications, dosages, prices, and producers.

Librairie Armand Colin, Paris Ve.: *Chimie macromoleculaire, Vol. I: Generalities,* by G. Champetier; 1957, 214 pp., paperbound.—An introduction to the chemistry of macromolecules: structure, synthesis, determination, and properties.

Calendaria A. G, Immensee: *Die Injektionsloesungen,* by H. Hager; 1955, 179 pp.; paperbound.—A descriptive listing of the requirements for the preparation of the more important injectables—from acetylcholine chloride to yohimbine hydrochloride (95 pp.)—with a discussion of the modern methods of preparing injectables and an extensive experimental section chiefly concerned with sterilizing problems. In addition to the author's numerous investigations, many tables and 382 references are included in the text.

Springer-Verlag, Berlin W 35: *Neuere Anschauungen der organischen Chemie,* by E. Mueller; 2nd ed., 562 pp. (71 ill.); DM 59.60.—The modern viewpoints of chemistry and physics, especially those based on the election and quantum theories —are presented in this textbook of organic chemistry. The intramolecular changes of structure and the relationship between constitution and color of compounds are emphasized wherever possible.

Fisher Scientific Co., Pittsburgh 19, Pa., opened in September its ninth plant. It is located on Gulph Road (Route 23), King of Prussia, in the Greater Philadelphia area.

About AIC Members

John H. Nair, F.A.I.C., chairman of the planning committee of the American Chemical Society, announces that Dr. Carl Shipp Marvel, Hon. AIC, research professor of organic chemistry, University of Illinois, has been named chairman of the $3,000,000 building fund campaign to construct a new headquarters building for the Society.

Dr. Fred J. Emmerich, Hon. AIC, retired chairman of the board, Allied Chemical & Dye Corp., New York, N. Y., received the "Man of the Year" Scroll of the Beta Gamma Sigma Alumni, at a dinner at the New York University Club, New York, N. Y., October 10th.

Dr. Eric J. Hewitt, F.A.I.C., vice president, announces that two senior research chemists have been added to the technical staff of Evans Research & Development Corp., New York 17, N. Y.

Bernard R. Krashin, M.A.I.C., president of Colton Chemical Co., Cleveland, Ohio, division of Air Reduction Co., Inc., announces a new product, Vinac RD Powder, or polyvinyl acetate.

Mildred Hunt, F.A.I.C., is editor of "What's new with lithium", published by the American Lithium Institute, Inc., 32 Nassau St., P. O. Box 549, Princeton, N. J.

Dr. J. C. Warner, Hon. AIC, president, Carnegie Institute of Technology, was general chairman of the Conference on Engineering and Scientific Education, held by the Engineers Joint Council of New York 18, N. Y., in Chicago, Ill., Oct. 31-Nov. 2, 1957.

Dr. Robert P. Parker, F.A.I.C., general manager of the Research Division, American Cyanamid Company, announces that Dr. Francis E. Fontain has been named director of the Pearl River (N. Y.) Research Laboratories.

Nicholas C. Gangemi, F.A.I.C., has been appointed director of research for Pennsylvania Industrial Chemical Corp., Clairton, Pa. He is located at the company's Research Laboratories, Chester, Pa.

Dr. W. R. Smith, F.A.I.C., has been appointed associate technical director and consultant in fundamental carbon black research by Godfrey L. Cabot, Inc., of Boston, Mass.

Dr. William J. Sparks, Hon. AIC, has been appointed to the science development council of Rensselaer Polytechnic Institute, Troy, N. Y. He is scientific advisor for Esso Research & Engineering, Linden, N. J.

E. M. Dannenberg, F.A.I.C., has been appointed director of carbon black research by Godfrey L. Cabot, Inc., Boston, Mass.

Dr. Hal G. Johnson, F.A.I.C., vice-president of Vick Chemical Co., addressed the Chemical Industry Association, December 10th, in New York, N. Y., on "The Role of the Chemical Industry in a National Emergency."

William L. Abramowitz, F.A.I.C., is now president of Carlton Products Corporation, 10225 Meech Ave., Cleveland, Ohio, manufacturer of plastic pipe and fittings.

Dr. Alexander Schwarcman, Hon. AIC, spoke before the International Congress of Chemists, at Athens, Greece, September 19th.

Savery F. Coneybear, F.A.I.C., associate director of research, Colgate-Palmolive Co., has been elected president-elect for 1958 by the Society of Cosmetic Chemists, 2 East 63rd St., New York 21, N. Y. **Dr. Walter A. Taylor,** F.A.I.C., of Pond's Extract Co., was re-elected as treasurer. **Dr. Paul G. I. Lauffer,** F.A.I.C., of Northam Warren Company, was elected as a director.

J. L. Yamins, F.A.I.C., assistant to the president, National Dairy Products Corp., Oakdale, L. I., N. Y., reports that the following AIC Fellows have been elected Fellows of the New York Academy of Science in recognition of their scientific achievements: **Dr. Herman S. Bloch** of Universal Oil Products Co., Des Plaines, Ill.; **Maison G. DeNavarre,** Cosmetic Laboratories, Inc., Detroit, Mich.; **Dr. Mark W. Tapley,** Sterling Drug Co., New York, N. Y., and **Dr. Pierre Van Ryssselberghe,** Stanford University, Stanford, Calif.

C. P. Neidig, F.A.I.C., partner of White-Weld & Co., in charge of the Philadelphia office, has been elected to the board of directors of The Stepan Chemical Co., 20 N. Wacker Drive, Chicago 6, Illinois.

Edwin J. Barth, F.A.I.C., consultant, 378 West End Ave., New York 24, N. Y. has been elected a Fellow of the Association for the Advancement of Science.

Paul Brna, F.A.I.C., has been promoted to district-sales manager of the Mid-West Division of Rhodia, Inc., of New York, with headquarters in Chicago, Ill., where he is responsible for sales of products of Rhodia's Aromatic, Flavor and Alamask Division and the Pharmaceutical Division.

Dr. Lloyd A. Hall, F.A.I.C., technical director, The Griffith Labs., Inc., Chicago, Ill., was one of twelve Distinguished Citizens, who received an Award from the Chicago Committee of One Hundred, for outstanding civic work, November 29, 1957.

Dr. Robert E. Hulse, F.A.I.C., vice president, National Petro-Chemicals Corp., announces that the second polyethylene plant of the firm will be constructed on a 200-acre site on the Houston Ship Channel, Texas.

Dr. William H. Bowman, F.A.I.C., general manager, Organic Chemicals Division, American Cyanamid Co., New York 20, N. Y., announces that Hugh Puckett has been named director of sales for the Division.

Samuel Schenberg, F.A.I.C., supervisor of science for the Board of Education, New York, N. Y., headed the committee which prepared the curriculum for a course on scientific developments and classroom instruction techniques at Brooklyn College for New York City high school chemistry teachers. The course was offered without charge, with registration and tuition fees provided by Chas. Pfizer & Co., Inc. of Brooklyn, N. Y.

Dr. R. Lindley Murray, Hon. AIC, chairman of the board of Hooker Electrochemical Co., Niagara Falls, N. Y., announced, jointly with Gordon H. Chambers, board chairman of Foote Mineral Co., Philadelphia, Pa., that the two companies are together exploring possibilities for the development of components of high energy fuels.

Dr. Joseph Rossman, F.A.I.C., chemical patent attorney, Philadelphia 3, Pa. and Washington, D. C., has been elected an honorary member of the Patent Office Society, "in recognition of his outstanding and notable contributions toward betterment of the patent system and the Patent Office."

John D. Hetchler, F.A.I.C., is now manager of the new Chemical Division of Werner G. Smith, Inc., Cleveland 13, Ohio, which will manufacture new products to expand the company's line of sperm whale, fish, and core oils.

Dr. Hans F. Winterkorn, F.A.I.C., professor of Civil Engineering, Princeton University, Princeton, N. J., was presented with the Cross of Merit, First Class, of the Order of Merit of the Federal Republic of Germany, by Consul General D. Adolph Reifferscheidt, on September 27th at Princeton. He was cited for his contributions to the reconstruction of Germany through assistance in the application of new methods in building of roads and highways.

John B. Calkin, F.A.I.C., president of Calkin & Bayley, Inc., industrial consultants, 50 E. 41st St., New York 17, N. Y., announces that Robert F. Peavey has been elected vice president in charge of metallurgy.

David W. Young, F.A.I.C., research associate at Sinclair Research Laboratories, Inc., Harvey, Illinois, has been appointed "research consultant" to the War Department on a part-time basis. Recently he was one of the judges at the 8th Annual Undergraduate Chemistry Symposium presented at De Paul University.

Dr. Winfred J. Cauwenberg, F.A.I.C., is now with the Pigments Division, American Cyanamid Co., Piney River, Nelson Co., Virginia.

Dr. Kenneth D. Johnson, F.A.I.C., is assistant to the vice president of Atlantic Research Corporation, 901 N. Columbus St., Alexandria, Va.

Opportunities

Doris Eager, M.A.I.C.

Positions Available

Sales Manager. Vinyl resins and plasticizers. 10 years experience in plastic sales with following in trade. B. S. in chemistry. Able to supervise and control sales force, select and train new salesmen, maintain good customer relations, establish effective sales program. New York location. Salary $12-$15,000. Age 35-50. Box 21, THE CHEMIST.

Chemist, male or female. Degree in chemistry. Some experience in field of soaps and detergents. Salary up to $95 per week. Apply in person or by mail: Personnel Office, Hearst Magazines, 309 West 56th St., New York 19.

Chemists Available

Chief Chemist—*Director of Research.* 20 years experience. Textile chemical specialties. Analysis, research, development, pilot plant and production. Morris Mytelka, F.A.I.C., 33-37—166th St., Flushing 58, L. I., N. Y. Phone: FLushing 9-8106.

Chemist, inorganic, eleven years industrial experience, general physical and chemical commercial testing, some supervisory experience. Seeks position in New Jersey and environs Box 20, THE CHEMIST.

Carl L. Masters, F.A.I.C., retired from National Aniline Division of Allied Chemical Corp., Buffalo, N. Y., is now residing at Jekyll Island, Georgia.

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This property permits the selective precipitation and separation of many cations. EDTA has been employed for its "masking action" on trace metals often present as contaminants. EDTA can be used for the determination of many metallic ions employing various analytical techniques including spectrophotometry and titrimetry. For many applications the disodium salt (dihydrate) of EDTA is preferred because of its solubility and favorable pH.

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Ethylenediamine Tetraacetic Acid (EDTA) and Disodium Ethylenediamine Tetraacetate, Dihydrate, are offered in the reagent grade as a crystalline powder of minimum 99 per cent assay. Critical impurities–heavy metals and iron–are held to low levels. Both reagents are stable and may be used directly for the convenient preparation of solutions.

APPLICATIONS

- In Colorimetry–EDTA serves as a masking agent and as a component of color systems.
- In Selective Separations–EDTA functions as a complexing or masking agent to reduce interferences thus permitting more selective reactions and separations.
- In Polarography–EDTA serves as a masking agent and complexing agent.
- In Titrimetry–EDTA as its disodium salt serves as titrant in the EDTA titration by which over 40 elements may be determined. This titration usually employs metal indicators, some of which have been introduced or offered by J. T. Baker in the reagent grade with controlled sensitivity. These include Eriochrome Black T, murexide, PAN, Pyrocatechol Violet, Zincon and calcon.

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